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2	BRS	L2	214953	(remote or remotely or center or central or centrally or net or network or lan or wan or communicate or communication or internet or intranet) near5 (request or requesting or requested or demand or demanded or demanding or obtain or obtained or obtaining)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:53
3	BRS	L3	1855	1 same 2	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:53
4	BRS	L4	427824	(remote or remotely or center or central or centrally or net or network or lan or wan or communicate or communication or internet or intranet) near5 (generate or generated or generating or generation or build or building or built or construct or constructed or constructing or construction or combine or combined or combining or combination or create or created or creating or creation)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:53
5	BRS	L5	359	1 near10 4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:53

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6	BRS	L6	61904	1 near10 (email or mail or message or messaging or communication or packet or information or data or file or image or music or picture or book or text or content)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:53
7	BRS	L7	54	3 and 5 and 6 <i>Scanned Ti, Ab, Kwic all</i>	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:54
8	BRS	L8	734978	(cost or costing or price or pricing or fee or feeling or rate or rating or bill or billing or charge or charging or amount) near5 (email or mail or message or messaging or communication or packet or information or data or file or image or music or picture or book or text or content)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:55
9	BRS	L10	10765	8 near5 (allocate or allocated or allocating or allocation or split or splitting or apportion or apportioned or apportioning or distribute or distributing or distributed)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 15:57
10	BRS	L15	1242	10 near5 (send or sender or recipient or addressee or carrier or shipper or internation\$3 or provider or isp or network)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 16:05
11	BRS	L16	1202	10 near5 (postage or indicia or indicium or evidence or evidencing or mark or marking or frank or franking or image or flag or flagged or flagging or indication or indicate or indicating or indicated)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 16:08

	Type	L #	Hits	Search Text	DBs	Time Stamp
12	BRS	L17	79	15 and 16 <i>Scanned Ti, Ab, Kwik all</i>	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 16:08
13	BRS	L18	66	("2330227" or "5694322" or "5822738" or "5822739" or "5970481" or "6005945" or "6047272" or "6141654" or "20020194308" or "20030078893" or "6619544" or "6249805" or "6289323" or "6421709" or "5377354" or "6321267" or "6393464" or "0041366" or "200041366" or "200079455" or "0079455").pn. or ((@pd<=19710101 not @pd<=19470101) and (709/206 or 709/207 or 705/400 or 705/401 or 705/404).ccls.) <i>Scanned Ti all</i>	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB; USOCR	2004/06/25 16:22

	Document ID	Issue Date	Inventor	Current OR	Current XRef	Pages
1	US 6014722 A	20000111	Rudin, Yehuda et al.	710/240	340/825.51; 370/447; 710/57	7

L7 results

	Document ID	Issue Date	Inventor	Current OR	Current XRef	Pages
1	US 6240402 B1	20010529	Lynch-Aird, Nicolas James	705/400	379/114.14; 379/114.21; 379/114.25; 379/114.26	12
2	US 20020059138 A1	20020516	Priest, Craig et al.	705/39		27

717 results

	Document ID	Issue Date	Inventor	Current OR	Current XRef	Pages
1	US 6351764 B	20030501	CONNER, J et al.			13
2	US 6023723 A	19990701	KOPANS, D et al.			15
3	FR 2330227 A	19770701				13
4	US 6619544 B2	20030916	Bator, Felix et al.	235/381	235/495; 705/403; 705/59; 705/60	13
5	US 6421709 B1	20020716	McCormick, William B. et al.	709/206	709/207	19
6	US 6393464 B1	20020521	Dieterman, Jude Gerard	709/206	713/200	14
7	US 6321267 B1	20011120	Donaldson, Albert L.	709/229	370/351; 709/218; 709/227; 709/238; 713/201	43

718 results

	Document ID	Issue Date	Inventor	Current OR	Current XRef	Pages
8	US 6289323 B1	20010911	Gordon, Roy R. et al.	705/40	705/401	20
9	US 6249805 B1	20010619	Fleming, III, Hoyt A.	709/206	707/10; 707/104.1; 708/807; 709/207; 709/238; 709/249	9
10	US 6141654 A	20001031	Heiden, Richard W. et al.	705/408	235/375; 705/401; 705/410	11
11	US 6047272 A	20000404	Biliris, Alexandros et al.	705/400	379/93.24; 705/32; 705/34	8
12	US 6005945 A	19991221	Whitehouse, Harry T.	380/51		25
13	US 5970481 A	19991019	Westerlage, Kenneth R. et al.	705/417	705/31	25
14	US 5822739 A	19981013	Kara, Salim G.	705/410	235/375; 235/381; 705/401	15
15	US 5822738 A	19981013	Shah, Chandrakant J. et al.	705/410		21
16	US 5694322 A	19971202	Westerlage, Kenneth R. et al.	705/417	340/870.07; 705/30; 705/31; 705/34	24

L18 results



	Document ID	Issue Date	Inventor	Current OR	Current XRef	Pages
17	US 5377354 A	19941227	Scannell, Niamh C. et al.	718/103	706/45; 706/47; 719/314	9
18	US 20030078893 A1	20030424	SHAH, CHANDRAKANT et al.	705/60		15
19	US 20020194308 A1	20021219	Hall, Robert	709/219	709/206; 709/245	21

L18 results

US-PAT-NO: 6240402

DOCUMENT-IDENTIFIER: US 6240402 B1

TITLE: Charge allocation in a multi-user network

DATE-ISSUED: May 29, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Lynch-Aird; Nicolas James	Stowmarket	N/A	N/A	GB

US-CL-CURRENT: 705/400, 379/114.14 , 379/114.21 , 379/114.25 , 379/114.26

ABSTRACT: A communication network includes a communication monitoring point arranged

to monitor user identifiers in source/destination identifier fields to determine a charging scheme.

20 Claims, 10 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 5

----- KWIC -----

Brief Summary Text - BSTX (2): The present invention relates to a communication network and in particular to charge allocation in multi-user networks in which access to the network is not controlled by the network provider.

Brief Summary Text - BSTX (27): According to the invention a charge allocation system is provided for a communication network as described herein comprising a communication monitoring point and a charge allocation sub-system, the network being arranged to accept communications including one of a plurality of user identifiers associated with respective predetermined charging schemes in each of a source identifier field and a destination identifier field, and the charge allocation sub-system storing user information, associated user identifiers, and respective corresponding charging schemes, wherein the communication monitoring point is arranged to monitor identifiers in the destination and/or source identifier fields of a communication and transfer the identifier information to the charge allocating sub-system to determine the charging scheme.

Brief Summary Text - BSTX (28): According to the invention there is further provided a method of allocating charges in a communication network for a plurality of users in which one or more users is assigned a plurality of user identifiers each associated with a respective predetermined charging scheme, communications in the network include destination identifier and source identifier fields in which the user identifiers are held, and a communication monitoring point monitors the user identifiers to establish an appropriate charging scheme.

Detailed Description Text - DETX (13): Referring to FIG. 4 charging information can be maintained by the network operator in a suitable charging table in which an entry is kept against each allocated recipient identifier indicating the charging scheme associated

with the recipient identifier. For example a first unique recipient identifier RID.sub.1 is allocated to recipient R.sub.A and designates that the originator of the call be charged. Recipient identifier RID.sub.2 is also allocated to recipient R.sub.A and designates that recipient R.sub.A should be charged. Recipient identifier RID.sub.3 is also allocated to R.sub.A and indicates that the call originator should be charged, for example at a premium rate, a part of the call revenue going to recipient R.sub.A. Recipient identifier RID.sub.4 is also allocated to recipient R.sub.A and designates that the charge should be shared between the call originator and recipient R.sub.A, for example with each party paying one half of the charge.

Detailed Description Text - DETX (27): If desired, customers can communicate without using originator identifiers, i.e. with all parties using their recipient identifiers. This is the fallback case which matches the situation in known network arrangements with each customer normally having just one identifier which is used for all their communications. There would be no way to choose between the charging schemes associated with the two recipient identifiers and the network operator would have to use the default scheme of allocating usage charges to whichever customer is identified as the source of each packet.

Detailed Description Text - DETX (31): The invention further embraces the possibility of multi-party exchanges (many to many, one to many, many to one) without using originator identifiers in the same way as for two-party exchanges (one to one) with the participants all identified by their recipient identifiers and with each participant allocated the charges for the packets they source, according to the default step 24 in FIG. 6.

Detailed Description Text - DETX (54): An advantage in applying the scheme described in this document at the network layer (ISO layer 3) would be that a common set of customer identifiers could be used across a multiplicity of bearer networks in the manner shown in FIG. 10, as is the case with IP addresses (identifiers). This will, however, necessitate the ability to allocate charges for packets passing into, out of, or through each network domain 40A,40B,40C.

Claims Text - CLTX (11): 4. A communication network as in claim 1 including a charge allocation system comprising:

Claims Text - CLTX (35): 20. A method of allocating charges in a communication network for a plurality of users, said method comprising:

PGPUB-DOCUMENT-NUMBER: 20020059138  
PGPUB-FILING-TYPE: new  
DOCUMENT-IDENTIFIER: US 20020059138 A1  
TITLE: Message exchange server allowing enhanced message charge allocation,  
and method  
PUBLICATION-DATE: May 16, 2002  
INVENTOR-INFORMATION:  
NAME CITY STATE COUNTRY RULE-47  
Priest, Craig Etobicoke CA  
Hood, Grant Etobicoke CA  
US-CL-CURRENT: 705/39

ABSTRACT: A message exchange server, method and software are disclosed. An exemplary exchange server allows a plurality of users to communicate with each other is operated so that paying users may communicate with all of the plurality of users using the device and non-paying users are restricted from communicating with other non-paying users. Example embodiments prevent non-paying users from hearing personal greetings of other non-paying users; non-paying users may from sending messages to non-paying users; or non-paying users may from bridging telephone calls with other non-paying users. Corresponding paying users, on the other hand, may hear all personal greetings; send messages to all users; bridge calls with all users. Additionally the server may allow a charge associated with sending a message from a message originator to a recipient at a message exchange server to be allocated based on an indicator received from the message originator. This indicator indicates whether the charge is to be borne by the originator or by the recipient. If the charge is to be borne by the recipient, the recipient may later agree to assume the charge and hear the message, or decline the charge without hearing the message.

----- KWIC -----

Summary of Invention Paragraph - BSTX (19): [0017] In accordance with an aspect of the present invention, a charge associated with sending a message from a message originator to a recipient at a message exchange server is allocated based on an indicator received from the message originator indicating whether the charge is to be borne by the originator or by the recipient. If the charge is to be borne by the recipient, the recipient may later agree to assume the charge and hear the message, or decline the charge without hearing the message.

Detail Description Paragraph - DETX (25): [0056] Based on the received indicator, server 10 allocates charges associated with the message to the originator or recipient. Specifically, if charges are allocated to the originator (i.e. the originator is to pay for the message), as determined in step S604, server 10 preferably determines if the originator has enough money or credit left in a pre-paid account in step S606. Specifically, server 50 checks if the balance stored in field 290 of record 280 (FIG. 2D) associated with the originator is larger than zero (0). If not server 10 may optionally initiates a fund request sequence in step S608. During this fund request sequence, the

originator may be prompted for payment information by VRU 110 of server 10. Payment information could take the form of credit card information that could be entered by the originator by way of touchpad 84 and stored and processed by server 10. Server 10, in turn, may verify the payment information and increment the contents of field 290, replenishing the account balance with an amount that has been agreed upon in advance by the originator. Alternatively, the originator could be redirected to a human operator of server 10. The human operator may in turn query the originator for payment information and then manually update the originator's account balance stored in field 290. Conveniently, as the balance stored in field 290 is only checked at this time, a user may send messages that are not pre-paid without having money in his or her account.

Detail Description Paragraph - DETX (27): [0058] If the originator does not wish to pay for the message, charges are allocated to the recipient. An indicator of the originator's choice is also determined in step S602, server 50 adds an identifier to the control information associated with an about to be generated message, stored in field 276 of file 234 (FIG. 2C--corresponding to file 236 where the message the originator is to compose will be stored) in step S614 signifying the message has not yet been paid for. Thereafter steps S616 and onward are performed.

Claims Text - CLTX (2): 1. At an apparatus facilitating exchange of stored voice messages, a method of allocating charges associated with sending messages from a message originator to a recipient, comprising: receiving from said originator an indicator of whether a charge for a voice message is to be borne by said originator or by said recipient; allocating said charge to one of said originator and said recipient, based on said indicator.

Claims Text - CLTX (8): 7. The method of claim 2, further comprising prompting said recipient to accept said message and assume said charge, if said charge has been allocated to said recipient.

DIALOG 25 JUNE 2004

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File 810:Business Wire 1986-1999/Feb 28 (c) 1999 Business Wire  
File 813:PR Newswire 1987-1999/Apr 30 (c) 1999 PR Newswire Association Inc

Set	Items	Description
S1	628898	(POSTAGE OR INDICIA OR INDICIUM OR EVIDENC??? OR MARK??? OR FRANK??? OR IMAGE OR FLAG????? OR IMPRESSION OR INPRINT????? OR IMPRINT?????) (5N) (STATUS OR IMPORT??????? OR PRIORIT?????????)
S2	893249	(REMOTE??? OR CENTER OR CENTRAL??? OR NET OR NETWORK OR LAN OR WAN OR COMMUNICATE OR COMMUNICATION OR INTERNET OR INTRANET) (5N) (REQUEST??? OR DEMAND????? OR OBTAIN???)
S3	1138	S1 (S) S2
S4	2145671	(REMOTE??? OR CENTER OR CENTRAL??? OR NET OR NETWORK OR LAN OR WAN OR COMMUNICATE OR COMMUNICATION OR INTERNET OR INTRANET) (5N) (GENERAT????? OR BUIL????? OR CONSTRUCT????? OR COMBIN??????? OR CREAT?????)
S5	1048	S1 (10N) S4
S6	75646	S1 (10N) (EMAIL?? OR MAIL?? OR MESSAGE????? OR COMMUNICATION?? OR PACKET?? OR INFORMATION OR DATA OR FILE?? OR IMAGE?? OR MUSIC OR PICTURE?? OR BOOK?? OR TEXT OR CONTENT)
S7	11	S3 AND S5 AND S6
S8	3430297	(COST??? OR PRIC??? OR FEE??? OR RAT??? OR BILL??? OR CHARG????? OR AMOUNT??) (5N) (EMAIL?? OR MAIL?? OR MESSAGE????? OR COMMUNICATION?? OR PACKET?? OR INFORMATION OR DATA OR FILE?? OR IMAGE??)
S9	659032	(COST??? OR PRIC??? OR FEE??? OR RAT??? OR BILL??? OR CHARG????? OR AMOUNT??) (5N) (MUSIC OR PICTURE?? OR BOOK?? OR TEXT OR CONTENT)
S10	62206	(S8 OR S9) (5N) (ALLOCAT????? OR SPLIT????? OR APPORTION????? OR DISTRIBUT?????)
S11	3899	S10 (5N) (SEND OR SENDER OR RECIPIENT OR ADDRESSEE OR CARRIER OR SHIPPER OR INTERNATIONAL??? OR PROVIDER OR ISP OR NETWORK)
S12	4445	S10 (5N) (POSTAGE OR INDICIA OR INDICIUM OR EVIDENC????? OR MARK??? OR FRANK????? OR IMAGE OR FLAG????? OR INDICAT?????)
S13	196	S11 AND S12
S14	207	S7 OR S13
S15	152	RD S14 (unique items) [Scanned ti,pd,kwic all]
S16	70	SPAM/TI (5N) SENDMAIL/TI
S17	940683	HALL/IN
S18	122	UNWANT???/TI AND EMAIL/TI
S19	192	S16 OR S18
S20	83	RD S19 (unique items) [Scanned ti,pd all]

3/9/3 (Item 1 from file: 15)

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How to \*avoid\* \*unwanted\* \*email\*

Hall, Robert J

Communications of the ACM v41 n3 PP: 88-95 Mar 1998

ISSN: 0001-0782

JRNL CODE: ACM

DOC TYPE: Journal article

LANGUAGE: English

LENGTH: 8 Pages

SPECIAL FEATURE: Charts References

WORD COUNT: 4708

**ABSTRACT:** Despite looking like conventional e-mail, a channelized mail address and its related agent allow e-mail users to reliably cut out unwanted correspondence. Unwanted communication ranges from nuisance to annoyance to dangerous to the very medium conveying the message. The usefulness of e-mail is seriously threatened by the commercialization of the Internet because it is easier than ever to collect address lists and cheaper than ever to mass-distribute messages. The main technique today for avoiding unwanted communication is to restrict the set of people to whom users give their addresses. The channels approach exploits this idea, providing a simple yet effective way to avoid unwanted e-mail. The PCA can essentially automate all the operations necessary to manage the complexities introduced by channels, so routine daily use is transparent to e-mail users. Channels complement cryptographic authentication, because they give control over messages received from unknown correspondents, such as advertisers, survey takers, harassers, and mailing list contributors.

**TEXT: Headnote:**

Despite looking like conventional email, a channel\*ed email address and its related agent allow email users to reliably cut off unwanted correspondents.

Unwanted communication ranges from nuisance (junk mail) to annoyance (telemarketing) to dangerous to the very medium conveying the message (junk fax, obscene or harassing telephone calls). The usefulness of email is seriously threatened by the commercialization of the Internet because it is easier than ever to collect address lists and cheaper than ever to mass-distribute messages.

If companies spent as much money sending junk email as they do sending junk physical mail, an established Internet user would likely get more than 100 junk messages per day. Every time a user sends a message to a public newsgroup or list, fills out a Web form, or mails in a product registration card, the server cheaply obtains an email address and usually some indication of the user's interests.

This information is then sold to marketing firms that easily automate mass emailings of advertisements, surveys, and other annoyances that cost the user connect



time and, worse, valuable attention. More sinister unwanted email is becoming common as well, including harassing and hate mail.

The main technique today for avoiding unwanted communication is to restrict the set of people to whom users give their addresses. For example, people pay to avoid having their phone numbers listed; in email, people sometimes maintain multiple email accounts, using different accounts for different purposes, such as commercial vs. personal. This unlisted address approach is expensive and slow to recover from security breaches; if an address is leaked to an adversary, the only alternative is to pay the service provider to change it (often a lengthy process). Once the address is changed, the customer has to notify all legitimate correspondents of the change while keeping it from adversaries. Leaks of physical mail addresses can be crudely located by systematically varying an address slightly as it is given to different correspondents, by, say, using a different nickname or middle initial when filling out forms. When correspondent leaks a variant, such as through selling a mailing list, the user can deduce the leak from the address used on ensuing unwanted messages. This technique is limited because even though a leak can be traced, little can be done to cut off the resulting unwanted communication.

Here I offer a novel technique called "email channels" that builds on and systematizes these ideas in the domain of email communication. It solves the problems involved in unlisted numbers and physical mail addresses, as well as additional problems introduced by the nature of email, providing a light-weight, finegrained access-control method. It works like this: A user's email account is made accessible via a user-controlled set of channels. Each channel has a distinct structured address containing the account name and a cryptographically secure, or unguessable, pseudo-random security string known as a channel identifier. Each legitimate correspondent is allowed to know one of these access addresses. The account owner is provided simple controls for opening a new channel, closing a channel, and switching a channel by notifying selected correspondents that a new channel is replacing the current one. Using email channels raises a host of potential complexities for the user, including security ease of use, and administration. To deal with them, I designed and implemented an automated personal channel agent (PCA) that shields the user from most of these complexities. In routine daily use, channelized email looks and feels to the users exactly like traditional email, and users need only infrequently access the extra administrative controls. See [6] for more detailed information about email channels and the PCA.

#### Channelized Addresses

A channelized address is an email address in the form Username-Channel ID@Host. An example is hall 1-lxyz6q6py4@research.att.com in which the user's name is hall, the channel ID is lxyz6q6py4, and the host is research.att.com. Note that this address contains both traditional address information, such as host and user names, and an unguessable channel identifier. The user has typically allocates and opens a number of these addresses differing only in the channel ID, for different correspondents. The goal is to control the access of potential correspondents, not to ensure anonymity of the account owner or guarantee the privacy of the messages.

Channel identifiers. Each channel identifier has two parts: a security string and a channel class indicator. It is critical that channel identifiers be practically unguessable, even when an adversary knows several of the user's other channel

identifiers. Thus, the prototype generates security strings pseudo-randomly using the cryptographically secure BlumBlumShub (BBS) generator [ 1], with a modulus size larger than 1,024 bits. See Schneier [11] for other candidate generators. A channel ID contains 45 pseudo-random bits. This large number of bits implies that if a user maintains 128 open channels, an adversary has one chance in about 275 billion of guessing an open channel with one message. A brute force attack, sending more than 100 billion messages to the same host, is impractical in today's Internet. Moreover, the security of BBS [ 1 ] implies that adversaries who know previously generated bits have essentially no advantage in guessing further bits.

Due to character-set restrictions in Internet mail protocols, the 45 pseudo-random bits are encoded into strictly alphanumeric ASCII characters five bits at a time, using only one case of the alphabet and the digits 3 through 8. I use this base-32 scheme rather than the more standard base-64 encoding, because the latter uses both cases of the alphabet, and not all mail systems on the Internet maintain the alphabetic case of header fields. When a message is received, alphabetic case is ignored in comparing the channel ID to those in active channels.

The channel class indicates how mail on that channel can be treated by the recipient. The current prototype implements three classes:

Class 0, which indicates a send-only channel, that is, one that is permanently closed. These channels are useful as return addresses when a user wants to send a message to a public or adversarial address without giving away any access at all.

Class 1, which indicates a private channel. The user expects mail from a known set of correspondents on such a channel. Mail from other correspondents may be ignored on it. Class 2, which indicates a public channel. Previously unknown correspondents may send on such a channel.

In the future, I plan to implement a richer class scheme, including the following classes:

- 0. SendOnly
- 1. Private
- 2. Permanent Public
- 3. Temporary Public
- 4. Commercial
- 9. Introductory

Thus, a channel identifier has the form Cxxxxxxxx, where C is a digit indicating the class and the xs encode the security string.

Applications. The multiple channels idea has several applications. For example, how can a user participate in a public forum, such as a mailing list, without giving away access? At subscription time, the user sends a public channel address to the list maintainer. All messages sent to the list will be delivered to the user on this channel. However, to send a message to the list itself, the user uses a send-only return address. Anyone wishing to reply has to send to the entire list.

Users wishing to allow private replies can allocate a limited-lifetime public channel, using it as the return address, perhaps explicitly indicating when it is to be deactivated. Users wishing to respond to the post can do so privately for a short while, but firms collecting interestbased mailing lists are left with closed channels after the

time-out period. Users can always choose to upgrade a correspondent to a permanent channel once contact is made.

Channels and list servers together can be used to implement private mailing lists, allowing groups to confer without requiring that they all have direct channels to each other, while prohibiting outsiders from sending to the group. The idea is simply to establish a list server with an unguessable address known only to list members. Note that list members need not have direct channels to each other, so a private mailing list might be useful, for example, when a single buyer needs to have a group discussion, such as an auction, with vendors that are mutually adversarial.

Channelized email can also enhance the effectiveness of email agents and filters [2, 5] by providing categorization based on which correspondents are presumed to know which channels. For example, when filling out a registration form for a product, one can use a particular public channel. The filter could be instructed to classify all traffic on that channel as lower priority than traffic on more personal channels. Furthermore, once electronic money becomes widely used, one can also implement payper-view channels. The idea is that the channel agent accepts a message on a pay-per-view channel only if accompanied by enough e-money to pay for the user's time viewing the message. Compensating the user for viewing ads, surveys, and more may increase the effectiveness of such marketing tools (as coupons do). On an authenticated channel, the filter rejects messages not digitally signed [4, 10, 11] by an expected correspondent. Note that an authenticated channel could even have a well-known identifier, such as 1AUTHENTIC, since unauthenticated messages are discarded unseen.

Another useful synergy of channels and email agents is the idea of the introductory channel, or a public, pay-per-view channel with a well-known address. Each channel user with a powerful filtering agent, such as the Andrew system's FLAMES language [2], can establish a well-known public channel identifier, such as 9INTRODUCE. A message to user-9INTRODUCE-@host is automatically handled by first (politely) demanding a reasonable fee (say, \$1.00) for reading it, while promising to refund the fee if the message is subsequently determined to be a legitimate attempt at contact and not just junk mail. If the message is junk, the user simply keeps the fee. Such a channel address could be published in directories. The risk of unwanted email is reduced arbitrarily by setting an appropriate access fee for unknown correspondents, since there is presumably a price advertisers will not pay for mass mailings. Yet charging a fee still allows access to long-lost friends and relatives, since the fee is immediately refunded in such cases.

Implementation. It is easy for one's mail server to allow flexibility for channelized addresses. In one prototype (see Figure 1), a modified Unix sendmail [3] parses addresses, checking the user part in the system password file as usual and matching the channel ID part against a list of open channels maintained in the user's channels file. The message is bounced if either the channel is not open or there is no channel ID present in the address. While this implementation is based on sendmail, analogous changes should be straightforward for other mail-processing systems. In a recent all-Java channels implementation, a separate channel bouncer component performed this function before forwarding accepted messages to the regular mail server.

Security. The success of the channels approach requires that the user's mail server, client machine, and the local network connecting them cannot be systematically eavesdropped on by an adversary; otherwise, the eavesdropper would have access to all open channels appearing in the user's mail traffic. While this assumption about server security may not hold in all cases, it is plausible when, for example, the server is run by a reputable commercial online service. In that case, the server and at least part of the network are physically secure and administered competently. Moreover, users connect via modems over traditional voice lines, where eavesdropping requires relatively expensive hardware techniques, unlike connections over ethernet where peer hosts can freely snoop on the packet stream.

Note that the channels approach does not require the entire network to be impervious to eavesdropping. By giving correspondents individual access channels, the user discovers immediately which correspondent has breached security (either accidentally or by being eavesdropped). At that point, the user can either switch the channel, if the breach was a one-time occurrence, or establish a cryptographically authenticated channel. (This authentication feature is not yet implemented in the prototype.)

#### The Personal Channel Agent

Maintaining multiple channels manually would be cumbersome and error-prone, leading to several problems: Return address. Remembering which channel to use as your return address for a particular user would be onerous.

(Chart Omitted) Captioned as: Figure I.

\* Cc. When sending to multiple recipients, security is breached if one simply includes everyone's channelized addresses, since it is unlikely that every reader is authorized for each other's channel. For example, suppose one sends a message to a mailing list and cc's a friend's private channel address. The cc is visible to all list readers, so all gain unauthorized access to the friend.

\* Reply/forward. People frequently include a received message when replying to or forwarding it. If the message contains channel IDs, the user must remember to edit them out to avoid leaks. \* Anomaly tracking. It is useful to notice when users send on channels they are not authorized to use, so leaks can be isolated when they become a problem. However, the problem may take a while to appear, as more and more junk traffic builds up on a channel and the original leaks are forgotten. The PCA I designed and implemented manages these complexities on behalf of the user.

PCA implementation. Figure 1 shows how the PCA prototype fits into an email system. Conceptually, the PCA acts as an email proxy, sitting between the user's mail client and the mail server itself, with a Web browser or desktop window allowing administration of the PCA. All PCA interfaces use standard protocols, such as SMTP [9], POP3 [7], HTTP, and FTP, to interact with clients and servers, so no special client software is needed to use it. This proxy positioning allows the PCA to perform bookkeeping functions autonomously on both incoming and outgoing messages, shielding the user from channel-induced complexities.

This architecture allows the PCA to run on a host separate from the mail server's host, so any additional computational load incurred by the PCA can be distributed. Alternatively, the PCA could run on the same host if desired. The only additional load necessarily incurred by the mail server is in parsing the address

(insignificant) plus the time to check the channels file. This additional workload is significant only for large channel files or slow file access. If users want to keep open many channels, the PCA can store channel identifiers in a database format supporting faster access than that available from a flat file.

A key part of the PCA is the user channel database (UCDB) whose primary purpose is to record two mappings: the channel map and the correspondentaddress map. The channel map associates each correspondent with the channel on which the user expects to receive mail. The correspondent-address map associates each correspondent's user and host names with the channel ID on which to send to the correspondent, if any. In the current implementation, each correspondent is allowed at most one channel. While it might initially seem desirable to allow multiple channels per correspondent, recall that the primary purpose of the channels mechanism is to deny access by denying knowledge. No security is gained by a single person knowing two or more access channels for a correspondent. Instead, the logical separation of traffic from a single user can be implemented using existing email filtering techniques [2, 5].

Address rewriting. The PCA rewrites the header and envelope information of each message as it comes in or goes out, leaving the body unaltered. For incoming messages, it removes channel IDs from all header addresses before serving the message to the client. Header rewriting solves the reply/forward problem, because the header of the included original contains no channel IDs. Figure 2(a) shows the user's view in the mail client; Figure 2(b) shows what is actually transmitted and received.

(Illustration Omitted) Captioned as: Figure 2.

(Illustration Omitted) Captioned as: Figure 3. )

For outgoing messages, the PCA puts back channel IDs selectively before forwarding the message to the network. For a single-recipient message, the PCA simply obtains the appropriate to-channel and fromchannel to use from the UCDB of the sender and respectively puts them into the recipient and sender fields (in both the message headers and the SMTP envelope). This automatic addition of channel IDs solves the return address problem.

Multi-recipient messages are copied once per recipient listed in the SMTP envelope, and each copy is tailored to that recipient. Tailored copying solves the cc problem, because each recipient receives exactly one copy of the message containing only information s/he already knows.

Thus, to the user, virtually all messages appear without channel IDs, and email looks and feels like traditional email. But why rewrite headers at all? Why not put channel IDs only into the envelope and not insert them into header lines? The primary reasons are for interoperation with non-channel users and with non-SMTP mail systems. A non-channel user expects a valid return address to appear in the From field and puts a channelized address in the To field, leading to the return address and reply/forward problems. Moreover, some non-SMTP mail systems do not separate the header from envelope information.

Anomaly detection. The PCA checks each incoming message to determine whether the sender is expected to send on the channel the incoming message arrived on. Messages to private channels are checked to see whether the sender is a member of the channel. If not, the user is notified (once for a given user and channel) and the event logged in the UCDB. This notification and logging is not done for public channels,

because one expects previously unknown correspondents to send on public channels. Administrative interface. Users who need to open, close, create, delete, or switch channels use the PCA's administrative interface. One prototype serves this interface as an HTML form via HTTP, allowing the PCA to be on a machine other than the user's client machine if desired, while the Java-based prototype presents it in a window on the user's desktop (see Figure 3). The Synch button sends a message to the channels server, synchronizing its representation of the user's list of open channels with that of the PCA. The New button initiates a dialog allowing the user to create a new channel. The display list provides a view on the user's channel database, while the buttons below it enable operations on individual entries, such as closing a channel, switching channels, and deleting the entire entry.

Channel switching. It may sometimes be desirable to switch a correspondent from one channel to another, because either the old channel has been leaked to too many adversaries or the user wishes to upgrade the correspondent's access, from, say, public to private or temporary to permanent. If the correspondent does not use a PCA, upgrading requires notifying the user to make a manual address book change. In this case, the PCA helps only in sending out a notification message.

If the correspondent also uses a PCA, the switching can be automated via a channel switching protocol, allowing the user's PCA to make a change in the correspondent-address map of the correspondent's UCDB. However, such a protocol introduces a security risk; for example, an insecure protocol might allow a PCA to be tricked into sending private messages to a public forum.

Limitations and Future Work Limitations of the channels approach involve the following functional categories: Usability. From the client's viewpoint, a PCA routinely makes channels transparent to the email user. There are, however, several occasions when extra operations must be performed, including:

When a message is to be sent to a new correspondent, the correspondent's channelized address must be entered in the To field of the email client. The PCA then remembers the channel ID and inserts it into succeeding messages to that correspondent.

The user has to use the administrative interface to allocate new channels, such as for use in mailing lists, as temporary reply channels, and to close and switch channels.

\* Malicious actions by an eavesdropper or interdicter may have to be countered by changing the-security policy for a correspondent, such as by switching him/her to an authenticated channel.

I have tested the prototype in a laboratory setting, and initial experience has been positive; for example, the extra operations are relatively infrequent and have seemed easy to perform and understand. However, it is an open question whether most users will come to the same conclusion, particularly when real-world settings are rife with financially motivated adversaries. Future work will test the prototype under more realistic conditions to help settle such questions.

Interoperation with traditional email. While a correspondent who does not use a PCA must directly use the user's channelized address, most mail clients provide online address books, eliminating the need to remember or type the longer address. Due to the cc and reply/forward problems, the channel ID may be leaked when the correspondent

sends a multirecipient message. Automatic channel switching is not possible, but users' PCAs can automatically generate notifications to each correspondent on the changing channel, leaving it to the correspondents to update their own address books.

Directories. Any approach based on not telling everyone how to reach you appears to conflict with directories that tell everyone how to reach you. This tension results from wanting to be reachable by people, yet not wanting to have one's time and attention wasted. Channels help resolve this tension in two ways: One is more willing to publish an easily changeable address than a permanent address, and when e-money is commonplace, users can publish introductory channels in directories, allowing access to legitimate correspondents but financially deterring unwanted correspondents.

Internet telephony. While the channels idea is not easily extended to the traditional telephone network due to the fixed length of phone numbers, it should be usable with Internet telephony [12], since addresses can be arbitrarily long. The channels idea should even work when accessing Internet phone service from a standard telephone set, as long as the call is placed via a server running a PCA that could translate an input phone number or nickname into a channelized Internet phone address. Administration could be via a Web interface or, perhaps, automatic speech recognition. Channelized telephony would allow users to control not only who can call them, but when they can be called; for example, a user could cut off commercial calls during the dinner hour.

#### Other Approaches

The idea of augmenting the user name portion of an email address with information to aid in routing is not new. The Andrew mail system [2] uses addresses in the form user+info@host, whereby info is an arbitrary alphanumeric field. Each user may write code in the FLAMES language to process messages based in part on the contents of the info field. While the Andrew system could be used to implement the channels approach, it has not yet been used that way. Instead, it has been up to the good will of correspondents not to purposely miscategorize messages, by, say, sending junk mail advertisements to user+urgent@host. Such a system, with well-known or easily guessable channels, cannot stand up to the likely onslaught of unwanted email in the commercial world.

Kill files. Another way to avoid email is to automatically discard all messages from a particular user, site, or domain. However, this approach unfairly denies access to legitimate users at the site or domain and is easily evaded through forgery or by having multiple addresses. Channels makes it possible to grant access to any set of individuals, denying access to others, while forgery does not help an adversary evade the channel mechanism.

Email agents and filtering. Email filtering agents [2, 5] can be used to discard messages that fail to satisfy user-defined criteria. However, it is extremely difficult to define syntactic rules that reliably distinguish advertisements and surveys from legitimate messages. Consider the following message, excerpted from one I received recently after purchasing software from the company that makes software package Y:

From: frobbozEsomewhere.edu (Chuck Frobboz)

To: hall@research.att.com Subject: Difficulty using <sw package X> Dear Robert,

I have difficulty using <sw package X> with JR WordProcessor. [...exposition of some problem...] Isn't this frustrating? Maybe you 14 would like to check out <SW package Y>. It is really cool. Here is the URL: [...]

Regards.

Chuck

I read several mailing lists regularly where people describe legitimate problems using software packages. This message, really an advertisement, is so similar in form and content to them it would be extremely difficult to write an email filter that reliably discards it but lets through legitimate messages. On the other hand, if this email arrived on a channel allocated to commercial firms, it would have been easy to spot; in fact, a PCA could even demand e-money in advance for a slice of the user's attention. Cryptographic authentication. A user of cryptography can enforce access control by requiring that all messages be digitally signed by an authorized correspondent; the filter would discard any other messages. If available, this access control method would be an alternative to private channels when messages come from known correspondents, providing good protection against unauthorized messages. However, even though software packages are available to do the cryptographic operations [4, 10], reliably obtaining a correspondent's public key is problematic [11]. Even if this key-certification problem were solved, email software using this access-control method could not deal with messages from unknown correspondents, such as those received from mailing lists. Even messages digitally signed with certified keys are not guaranteed to be not junk. One can accumulate a (large) list of correspondents who send junk, but adversaries can evade this mechanism by registering several addresses and keys or by having different employees send different messages. Channels, on the other hand, allow one to absolutely shut off the flow of messages from an adversary by closing all channels known to it. To gain unauthorized access, users have to invest effort, risk, or money in eavesdropping or social engineering, while new access can be cut off easily once again after just one message.

Legislation. A government might consider extending existing laws governing junk physical mail and telemarketing calls to cover email. However, the global Internet is not governed by a single jurisdiction. Also, legislation would presumably be effective against only law-abiding junk mailers, not harassers and other undesirables.

#### Conclusions

If people don't know your address, they can't send you email. The channels approach exploits this idea, providing a simple yet effective way to avoid unwanted email. The PCA can essentially automate all the operations necessary to manage the complexities introduced by channels, so routine daily use is transparent to email users. Channels complement cryptographic authentication, because they give control over messages received from unknown correspondents, such as advertisers, survey takers, harassers, and mailing list contributors. In a time of increasing commercialism and decreasing individual privacy, the channels approach shows promise and should be pursued.

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